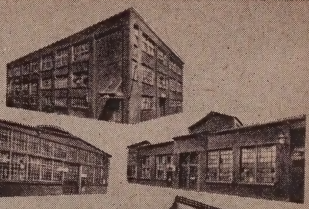
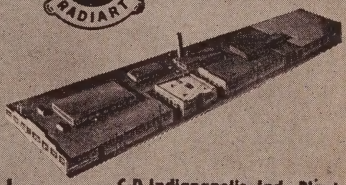
the CORNELL-DUBILIER C-D Capacitor



The Radiart Corp.
Cleveland, Ohio, Plants

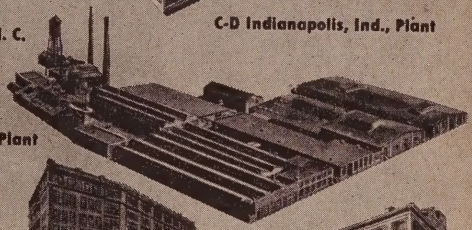
C-D Fuquay Springs Division, N. C.

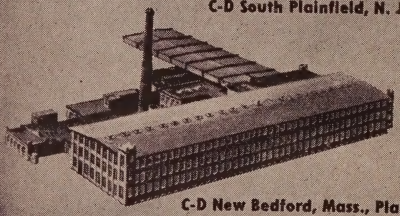


C-D Indianapolis, Ind., Plant

C-D Providence, R. I., Plant

C-D South Plainfield, N. J., Plant





C-D New Bedford, Mass., Plant

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C-D Cambridge, Mass., Plant

Vol. 17 APRIL, 1952 No. 4

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PROBES FOR RADIO-TV TROUBLESHOOTING

Instrument probes of various kinds serve a twofold purpose. They add new ranges and functions to test equipment and enable the technician to *extend* his instruments to the exact points of measurement in circuits under test.

Over a period of years, a number of special-purpose probes have been developed for use with the conventional instruments of radio and television servicing. The design of these probes has been varied, embracing a rather wide selection of component values. Usage, however, has established a certain set of values as optimum for each type. The units described in this article are more or less indicative of these crystallized designs.

The various probes increase the usefulness of test instruments both for measurement purposes and for troubleshooting. In most instances, they are inexpensive accessories which, if necessary, can be constructed with little effort by the experienced technician.

Meter Probes

D. C.—V. T. VOLTMETER PROBE. The isolating probe used with a d. c. vacuum-tube voltmeter is perhaps the one best known to radio servicemen. In its conventional form, this unit (See Figure 1) consists of a regular shielded test prod with a built-in 1-megohm resistor. The purpose of the resistor is, together with the shielding, to isolate the test-prod tip from capacitance effects due to the operator's hand and the test-lead cable. Since the input resistance of the v. t. voltmeter is 10 or more times the value of the isolating resistor, a small voltage division occurs as a result of the inclusion of this resistor in the circuit. However, the d. c. calibration of the meter takes into consideration the total resistance of the input voltage divider of the meter plus the isolating resistor. While it is customary to use 1 megohm in the d. c. probe, the improved isolation afforded by a higher value may be utilized, provided the total resistance of the input divider of the meter is multiplied by the same factor. Thus, a 2-megohm isolating resistor may be used in the probe, provided each resistor in the input voltage divider is changed to twice its original value. In this way, the meter calibration will not be disturbed.

When constructing a d. c. probe, care should be taken to mount the isolating resistor in the front end of the shielded probe handle as close as possible to the metallic prod tip. A ½ watt carbon resistor will be satisfactory, but it must be selected carefully to have the exact specified resistance value.

TELEVISION HIGH-VOLTAGE PROBE. A very high resistance in series with the input of a d. c. vacuum-tube or non-electronic voltmeter will adapt the instrument for the measurement of high voltages in television power supplies, industrial equipment,

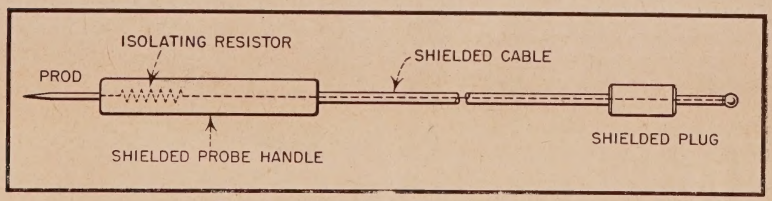


Fig. 1. D. C. V. T. Voltmeter Probe.

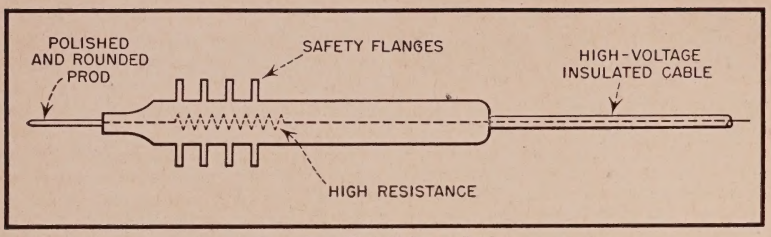


Fig. 2. High-Voltage Probe.

electromedical apparatus, transmitters, etc. The special high-voltage high-resistance cartridge must be mounted inside a safety-type probe handle, as shown in Figure 2, and the connecting cable must be made of high-voltage-insulated flexible wire. The metallic prod tip must be polished and its pointed end rounded off, to prevent corona.

These probes can be constructed or obtained commercially to multiply the 1000 volt scale of a v. t. voltmeter to 10,000 v., or the 300 volt scale to 30,000 v. The probe resistor (R_1) must be equal to 9 times the input resistance (R_2) of the v. t. voltmeter, in order to read 0-10,000 v. on the 1000 volt scale. In order to read 0-30,000 v. on the 300 volt scale of the instrument, R_1 must equal 99 times R_2.

High-voltage probes may be used also with conventional d. c. voltmeters. In these non-electronic meters, R_2 is not constant for all ranges, but is equal to the total resistance of the range used. This total value can be ascertained by multiplying the full-scale voltage of the range by the instrument sensitivity in ohms per volt. Thus, in a 1000-volt instrument of 20,000 ohms-per-volt sensitivity, $R_2 = 20{,}000 \times (1000) = 20$ megohms. The resistance of a 10,000-volt probe for this meter would be $9 \times (20) = 180$ megohms.

R. F. PROBE. Figure 3 shows the circuit of the familiar shunt-diode crystal-type r. f. probe for use with a d. c. vacuum-tube voltmeter. Radio-frequency input voltages as high as 20 volts r. m. s. may be applied to the crystal probe. The upper operating frequency is 100 to 200 Mc.

Seldom pointed out in descriptions of the crystal-type probe is the fact that the reading of the d. c. v. t. voltmeter will be equal to the negative *peak* value of the applied r. f. voltage.

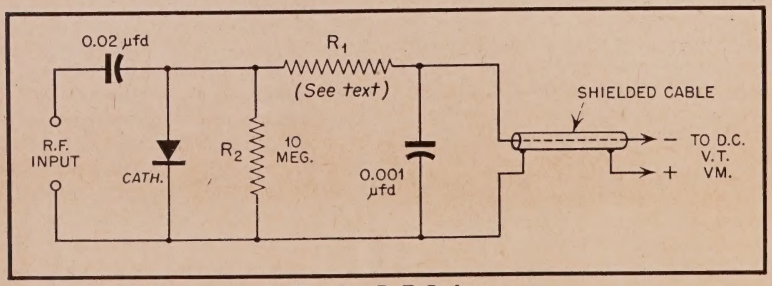


Fig. 3. R. F. Probe.

Since the r. m. s. voltage ordinarily is desired, the higher peak reading (1.414 times r. m. s.) will be somewhat confusing. A simple scheme for making the readings come out in r. m. s. values is to adjust the size of the filter resistor, R_1, so that a voltage division to 70.7% of the d. c. output of the crystal is obtained between this resistor and the top of the input voltage divider of the v. t. voltmeter. Since the probe feeds directly into the v.t.v.m. without the usual 1-megohm isolating resistor, 1 megohm must be added to the calculated value for R_1. For r. m. s. readings on the regular d. c. scales, R_1 must equal 1.414 times the input resistance of the meter, plus 1 megohm. Thus, for a 10-megohm-input instrument, $R_1 = 1.414(10 + 1) = 1.414 (11) = 15.554$ megohms. Because of non-linearity of the crystal at low input voltages, a special calibration will be required for a. c. scales below 0-10 v.

By using a ceramic capacitor, ¼ or ½ watt carbon resistors, and a small-sized germanium diode such as Raytheon CK705, the entire r. f. probe can be built into the shielded handle of a conventional meter test prod.

A. C. PEAK-TO-PEAK PROBE. Figure 4 shows a twin-diode probe suitable for measuring the peak-to-peak value of an applied a. c. voltage directly on the scales of a d. c. vacuum-tube voltmeter. A 6AL5 twin-diode tube is used. This probe is useful for checking the peak-to-peak value of complex, non-sinusoidal waveforms in television circuits.

The circuit is seen to consist of two separate shunt-diode peak rectifiers (one for the positive half-cycle; the other for the negative) with their inputs in parallel and outputs in series.

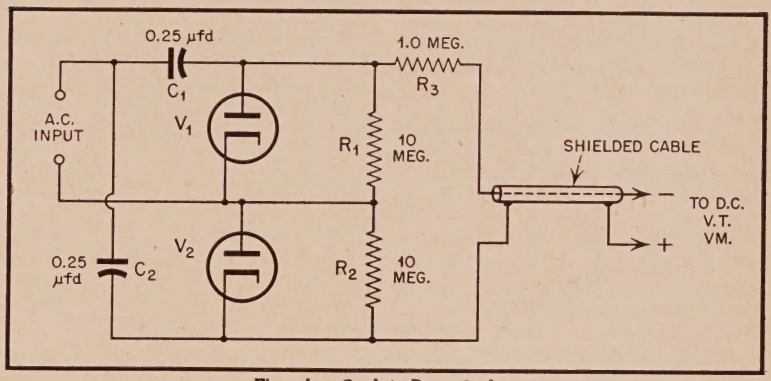


Fig. 4. Peak-to-Peak Probe.

Diode V_1 conducts when the upper a.c. input terminal is positive and charges capacitor C_1 to the peak value of the applied a. c. voltage. A d. c. voltage equal to this peak value appears across load resistor R_1. When the lower a. c. input terminal is positive, diode V_2 conducts and charges capacitor C_2 to the peak value of the applied a. c. A d. c. voltage equal to this peak value appears across resistor R_2. Since R_1 and R_2 are connected in series, the d. c. voltage across each are added. The d. c. voltage applied to the v. t. voltmeter accordingly is this sum which

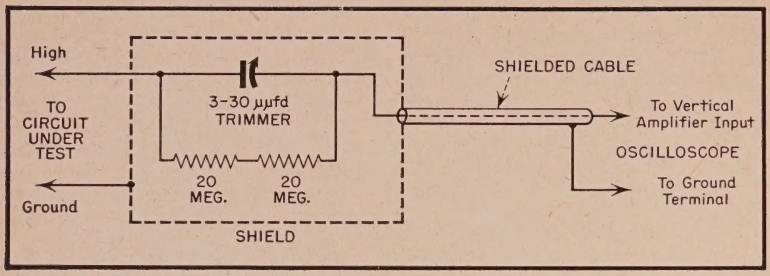


Fig. 5. Oscilloscope T. V. Probe.

is equal to the peak-to-peak value of the applied a. c. voltage.

The d. c. scales of the meter may be used directly except on ranges lower than 0-10 volts where a special calibration will be required.

The 1-megohm resistor, R_3, replaces the isolating resistor normally found in the d. c. probe of the v. t. voltmeter.

Oscilloscope Probes

T. V. OSCILLOSCOPE PROBE. The accurate display of television pulse patterns on the screen of a wide-band t. v. oscilloscope requires a test-cable termination probe of the type shown in Figure 5. The best display is secured when the trimmer capacitor is adjusted to a value equal to the total shunting capacitance of the probe cable and the vertical input circuit of the oscilloscope. The cable length should be restricted to not more than 3 feet.

DEMODULATOR PROBE. A demodulator probe is required when the oscilloscope is used for visual alignment of the r. f. stages (the i. f. stages also, ahead of the video detector) in a t. v. receiver. A crystal-type demodulator probe circuit is shown in Figure 6. The components may be attached to a small bakelite board, and the probe-input leads soldered temporarily to the circuit under test. In this way, long connecting leads and the necessity for handling the probe are eliminated. No shield-can will be required.

The function of the demodulator probe is to supply a low-frequency vertical deflection voltage for the oscilloscope proportional to the instantane-

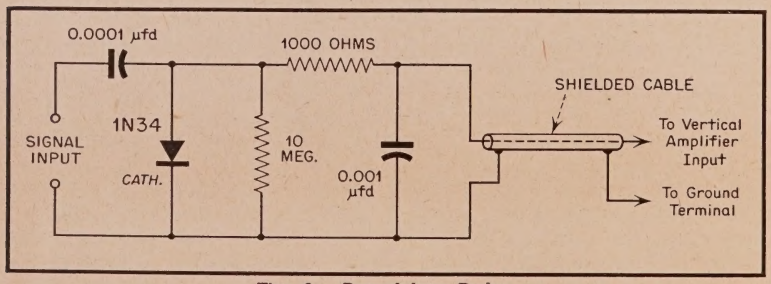


Fig. 6. Demodulator Probe.

ous response amplitudes which result from the application of a sweep generator signal to the circuit under test.

Signal Tracer Probes

SIGNAL-TRACER DEMODULATOR PROBE. The conventional aperiodic signal tracer employed for troubleshooting in radio and television receivers consists of a high-gain audio amplifier preceded by a demodulator probe. An amplitude-modulated r. f. test signal is applied to the input terminals of the receiver under test. The demodulator is used to pick this signal up at various test points in the circuit and to deliver the audio modulation component to the amplifier portion of the signal tracer. The demodulator, in essence, is a detector.

The circuit of an efficient signal-tracing probe is shown in Figure 7. This arrangement is similar to Figures 3 and 6, except that the rectified d. c. component is not used in this instance. Instead, the audio component resulting from the demodulation process is extracted by the 0.1 ufd. capacitor and presented to the amplifier portion of the signal tracer. For increased demodulation efficiency, a Type 1N54 high-back-resistance germanium diode is used.

An extremely simple aural signal tracer for use with an amplitude-modulated signal may be made by connecting a pair of high-resistance headphones to output terminals A and B. This arrangement will not have the high sensitivity provided by the amplifier, but will be useful when simplicity and the elimination of all power supply equipment are factors to be considered. This setup often is referred to as a *radio stethoscope.*

CAPACITIVE-TYPE SIGNAL-TRACER PROBE. A signal tracer of the "analyst" type employs a tuned r. f. receiver circuit to tune sharply to an unmodulated r. f. test signal picked up at various points in a receiver under test. The signal must be coupled into the tracer circuit by means of a capacitance small enough not to detune the circuit under test.

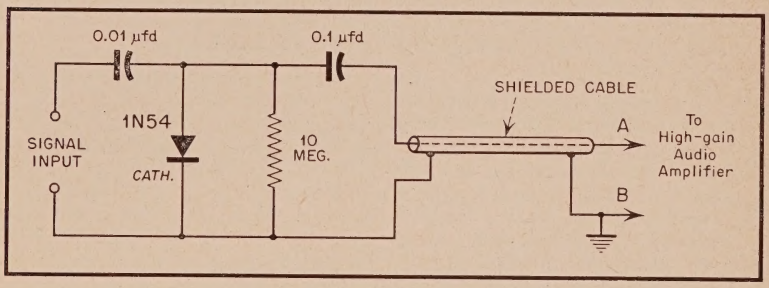


Fig. 7. Signal Tracer Probe.

Figure 8 shows a capacitive probe suitable for this purpose. The coupling unit is a 1- or 2-uufd. miniature ceramic capacitor mounted inside the shielded handle of the test probe as close as possible to the metallic prod tip.

Some signal attenuation takes place as a result of voltage divider action between the small input capacitor and the combined capacitance of the shield-

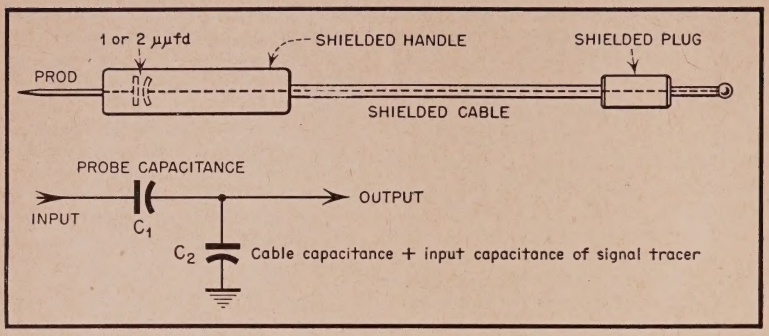


Fig. 8. Capacitive-type Signal Tracer Probe.

ed cable and the input capacitance of the tuned signal tracer. The equivalent circuit, also shown in Figure 8, illustrates the relationship between these two capacitances.

SIGNAL INJECTOR PROBE. A handy method of checking radio and audio equipment consists of injecting a signal at various test points and noting the presence or absence of operation. In a radio receiver, the signal is injected first at the loudspeaker, and then successively at the output and input of each stage back to the antenna input terminals. A dead stage is spotted by loss of the signal as the injection is transferred from output to input of the stage.

Figure 9 shows a combination radio-audio injector which may be built in the form of a probe. A 12AX7 twin triode is employed in a multvibrator operated at approximately 10 kc. The output is rich in harmonics, producing a rough signal which may be applied to either audio or radio circuits up to several megacycles. No tuning is required.

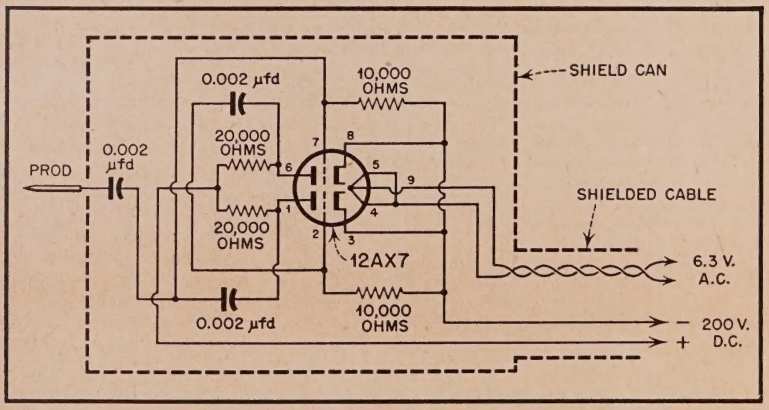
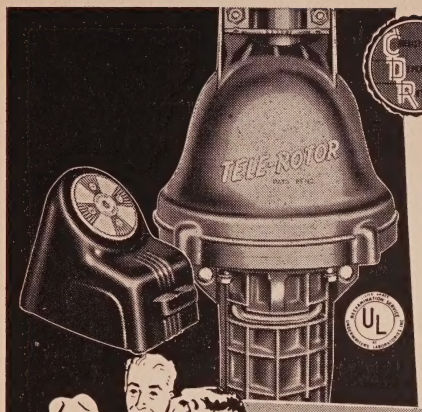


Fig. 9. Signal Injector Probe.



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MODEL TR-2 . . rotator with "compass control" cabinet having illuminated "perfect pattern" dial . . . (uses 8 wire cable) $49.95

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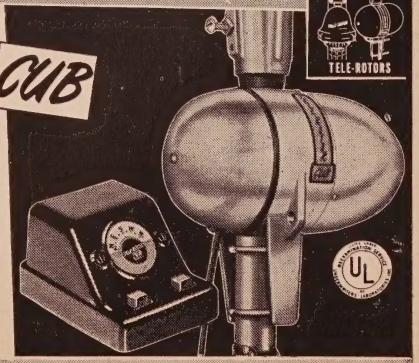
TELE-ROTOR CUB



The new TELE-ROTOR "CUB" is ideal for average installations. The same husky motor as the Heavy-Duty model . . . the "CUB" is the fastest and easiest of all rotators to install. All-In-Line design . . . with true in-line thrust between antenna and mast. The ¾" STEEL shaft rotates on a case hardened steel ball . . . with in-line reamed oilless bearings.

MODEL 502B . . . Rotator with plastic control cabinet having indicating meter for "hairline" tuning. (Uses 5 wire cable) . . . $44.95

MODEL 501B . . . . rotator with control cabinet having end-of-rotation signal. Light flashes every 7.2° showing antenna is turning. (Uses 5 wire cable) $34.95

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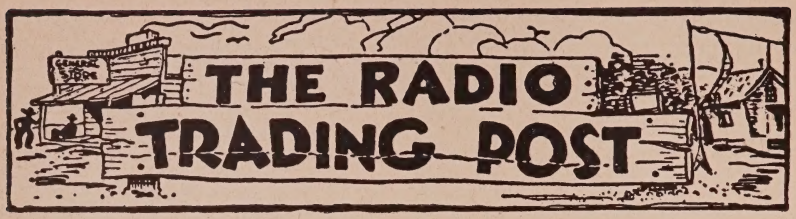

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FOR SALE—Miller TRF high fidelity AM-tuner with power supply, comp., $10; Scott 111B dynamic noise suppressor, comp., never used, $10. Nils Hulemark, 130 75th St., Brooklyn 9, N. Y.

FOR SALE—I-222 sig. gen., perf. cond., with crystals and extra coil forms $50. E. Schoenberg, 352 E. 7th Ave., Roselle, N. J.

WANTED—Zenith armchair radio-phono comb., blond finish cabinet, mod. No. 12-HO92E. Prefer cabinet only but will take comp. if reas. T. Quarnstrom, 131 E. Fifth Ave., Gary, Ind.

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SWAP—Good Hallicrafter S-41 rec. and or calibrated EICO VTVM Want good revolver .38 S & W or .38 Spec. Wm. C. Hite, 2221 12th St., S.W., Canton 6., O.

FOR SALE OR TRADE—One brand new Delco-Remy 6 V. gen., 30 amp., value $40. Also have intercom. master station to handle 8 remote speakers, good cond.; Need oscilloscope, battery eliminator or tube checker. C. W. Chastain, 228 Timber Lane, Memphis, Tenn.

TRADE OR SELL—Wilcox amplifier (6V6, 5V4, 6SN7, 6SN7, 6V6); Astatic mike; Motorola 505 auto radio; 1939 Chev. custom radio; 12 V. Dodge gen. Want known brand scope, test equip. or cash. Joe E. Brantley, Huron, Tenn.

WANTED—Book or man. on schematic diagrams of different kinds of radio recs. State lowest price. Will send money order. Cecilio V. Maisog, Aloran, Misamis Occ., Mindanao, Philippine Islands.

FOR SALE—Radio-TV-appliance business in prosperous rural area of Pa., comp. with parts, test equip., etc.; pop. 2000, plus 3000 rural area pop. Fine opportunity, est. 1938. Franchised Philco, RCA, Admiral dealer. Modern Electrix, 29 W. Market St., Middleburg, Pa.

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SWAP—Eico scope, good cond., assortment of resistors. Want Luger or other pistol, jigsaw, lathe, outboard motor or? James E. Munson, Box 186, Pembroke, Me.

FOR SALE—Six V. Radiart 455 Vibrapacks, 400 V. at 150 Ma-6x5 rectifier used 2 hrs. $22.50; 10 AVO plus 20 W. power amplifiers (made to WE spec.). John Richardt, 44 Valley Way, West Orange, N. J.

SWAP—National Radio Inst. serv. course without parts kit for camera, pref. 35mm. Max Paschke, Ardoch, N. Dak.

WANTED—Weston mod. 665 selective analyser; Weston 685 vac. tube tester; FJ-260A adapters and PL292 plugs. W. E. Schwenzer, 3619 Peach St., Erie, Pa.

SELL—EICO VTVM, factory tested, like new, $35 or trade for Frontier pistol; also 100 orig. label Glenn Miller records $1 ea. Jack Farrell, 19370 Stratford Rd., Detroit 21, Mich.

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SELL OR TRADE—WRL Globetrotter, 10-20-40 meter coils, good cond. $50; Mark II trans. rec. gen. $20; Meissner sig. shifter, prewar $30; all FOB. Want comm. rec. Joseph Guercio, 4371 Gunther Ave., Bronx 66, N. Y.

FOR SALE—Army BC-375-E transmitter & 3 tuning units, few parts missing $25; Precision telescope, 40 x 100 power, $35; Weston mod. 689 Type 1F ohmeter $8. B. Chahye, 5115 Elyria Ave., Lorain, O.

FOR SALE—Magnavox 15" 30 W. speaker; 8 ohm, 2" voice coil; 7 lb. Alnico magnet $18. Arthur Koehler, 130 Wadsworth Av., New York 33, N. Y.

TRADE OR SELL—Zeiss Super Ikonta "B" 2¼ x 2¼ camera, coated Tessar 2.8 lens; Compur rapid shutter to 1/400 sec.; case and some acc. Trade for good ham rec. or $120 cash. Gerald Liccione, 163 Oakdene Ave., Teaneck, N. J.

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FOR SALE—Set audio transformers for all triode amplifiers—UTC LS 21, LS 22 and LS 57 in orig. boxes, all for $25 or will swap. Willard B. Smith, 110 Stone Ridge Dr., Syracuse, N. Y.

WANTED—Disc or tape recorder comp. Epps Griffin, Rt. 2, Box 172-A, Pittsburg, Texas.

FOR SALE—Back issues of technical journal "Radio Science", containing tech. radio and constructional articles. Any 8 issues $1 posted. C. W. Birchmeier, Box 5047, GPO, Sydney, N.S.W., Australia.

FOR SALE OR TRADE—Hickok sig. gen. mod. 288X with db meter; Meissner analyst mod. 9-1040; Rider Man. 1-15; Equip. used once. Trade for motor winding equip. or mat'l. Palmer Benson, Tracy, Minn.

WANTED—Zenith radio, chassis and speaker mod. 50-52. Will trade Perfex 35mm camera for wire or tape recorder. Larson's Radio Service, Madison, Minn.

SELL OR TRADE—3" Westinghouse 0-100 dc ammeter, 50 millivolt movement., exc. cond. Will trade for DB or VU meter or sell. Kenneth R. Stevens, 4654 St. Paul Blvd., Rochester 17, N. Y.

FOR SALE—TR-9 trans.-receivers, 2.0 to 3.5 mc. unaltered, perf. for any portable, marine, aircraft or emergency work $49.50 ea. Deliver in 100-mi. radius Robert Clary, RFD 3, Flemingsburg, Ky.

WANTED—Measurements grid dip meter mod. 59 or Millan grid dip meter. Have tubes, condensers, meters and test equip. for trade or sale. Irving Mower, 4257 Park Heights Ave., Baltimore 15, Md.

WANTED—For Truetone auto radio mod. D1190-91, a tuning slug and coil, antenna, RF, or oscillator. Need only slug but will accept complete unit. Trade or cash. Have milliammeter, resistors, Jap. pocket voltmeter, etc. James Munsen, Pembroke, Me.

SELL—Supreme tube and set tester mod. 504-B, perf. cond. $75. Bro. A. Schmidt, St. Meinrad's Abbey, St. Meinrad, Ind.

WANTED—Lysco VFO, National 1-10 Bliley osc. CCO-2A Gonset 6 m. converter, Heathkit sweep gen. not using speaker for sweep. H. I. Griffihts, 39-82 65 Pl., Woodside 77, L. I., N. Y.

FOR SALE—Silver Vomax mod. 900 VTVM with HV probe $25. A. H. Lohmar, 4412 33rd Ave. So., Minneapolis 6, Minn.

SELL—National NC-125 with matching speaker, like new, best offer over $100. Sell or trade mod. A-200 sig. gen., exc. cond., want sig. tracer, capacitor analyzer or what have you? Gene's Radio Service, Clarendon, Ark.,

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FOR SALE—Supreme Man. vol. 1-5, 8; Arvin, G. E., Stewart-Warner man.; all good shape, $10; also NRI Man., 1598 pp. $10. Want Rider Vol. 6, 15; Sams Photofacts after Vol. 4. Harold Garrett, 711 South New York, Sedalia, Mo.

FOR SALE—Rider Auto. Record Changers and Recorders $5. A. E. Sweigert, Box 211, Cressona, Pa.

FOR SALE—Rider Man. 1-5 abridged, 6-10. Like new, highest cash offer only. Broadway Radio, 693 N. Broadway, E. Providence, R. I.

FOR SALE—2 TBY transmitter-rec. units, 20-80 Mc., comp., A-1 cond.; Lawrence Deluxe slide rule; 1941 ARRL Handbook, 8th Ed., coll. item. Best offer, cash. R. H. Ives, 663 Kempsville Rd., Norfolk 2, Va.

FOR SALE—AC-DC mod. 312 VOM, Chicago Ind. Inst., V. 0-250, 4 scales, M.A. 0-50, resistance 0-100,000 ohms. Perfect, $5 P.P. Alfred H. Owen, 6552 Maurice, St. Louis 9, Mo.

TRADE—Latest type Emerson portable, mod. 643A, 4 band, all wave, 115V AC-DC, battery, and 230V AC, comp., in original carton. Want sweep generator. D. J. Scandaglia, 1516 65th St., Brooklyn 19, N. Y.

FOR SALE—Rider Man. 2-14, except 9. 14 vol. in all, $70 plus post. G. H. Swiska, 109 E. School St., Woonsocket, R. I.

FOR SALE OR SWAP—NRI sig. gen., 150 Kc to 60 Mc.; NRI VTVM 20,000 O.P.V.; Brush Hi-Impedance headphones; 8" speaker with PP output. Want Eico line or what have you? Karl Nester, Box 76, Van Meter, Pa.

FOR SALE—Rider Man. 1-13, good cond. FOB Florida $75. M. A. Hanratty, Fellowsnip Center, Room C, Ormond, Fla.

FOR SALE—Phila. or vicinity, Hallicrafter Super Skyrider rec. plus speaker in good cond. $49; good for novices. Also T/22 Arc 5 $15, conv. for 40 meters. Ray Gianchetti, 9 N. Third St., Darby, Pa.

FOR SALE—Motorola man. cont. heads for '46 Olds, '47 Studebaker, '47 Ford-Mercury, '46 Chev., '46 Buick. Make offer. H. Seligson, New Hempstead Rd., New City, Rockland Co., N. Y.

TRADE—Single barrel shotgun, perf. cond.; Mauser 98K German inf. carbine; French 6.35 auto. pistol. Want tube tester, sig. gen. or what have you? F. Hellauer, 4135 De Reimer Ave., Bronx 66, N. Y.

WANTED—Midwest chassis and speaker, need not be in working order, 16 or 18 tube set; Sprague Teleohmike in good cond. Send full information and price of each. Vernon E. Hurd, 129 North St., Gloversville, N. Y.

FOR SALE—ATR battery eliminator and charger $23; 20,000 ohm-per-volt multitester; 4½" meter paper leads $17; oscilloscope $3; all in good cond. W. Siuta, 4011 Lawndale St., Detroit 10, Mich.

FOR SALE OR TRADE—Bound vols. Q.S.T. magazines in hard covers, exc. cond.; 1926-28, 30; 8 vols. in all. G. Novak, 5036 S. Kildare, Chicago 22, Ill.

FOR SALE—Comb. tape recorder with radio-phono, portable case $132; Heath SG-6 sig. gen. $30; FM-AM tuner and radio, cabinet, $33; Voigt. Bessa II camera with case $91; all like new. Walter Bartell, 1107 N. Western Ave., Chicago, Ill.

SALE OR SWAP—Philco 2500 proj. TV, in good cond, solid mahogany cabinet. Best offer FOB Buffalo or good 7.5 in./sec. tape recorder in good cond. R. S. Levy, 185 Woodbridge Ave., Buffalo 14, N. Y.

SALE OR TRADE—5 vol. McGraw-Hill Radio Eng. library; 5 vol. Coyne Radio library; 1 vol. Radio oper. q. and a., 10th ed.; 1 vol. No. 1 NRI Serv. Man. Trade for VTVM or oscilloscope or cash. William A. Voelker, Marine on St. Croix, Minn.

FOR SALE—Radio business; large stock, in good TV location. Will sell with business and living quarters. E. Kiehnhoff Radio Service, Box 355, Wathena, Kans.

WANTED—Short wave comm. rec. Have 2 Supreme mod. 542 multimeters not in working cond. Will trade for any ham gear. Norman J. McHale, 77 Turner Ave., Buffalo 20, N. Y.

TRADE—AM-FM-TV sig. gen. Eico mod. 315 factory wired, like new. Want Rider TV vol. 4 and 5, or 7 and 8 in exchange. George Meserole, 6810 Owlshead Court, Brooklyn 20, N. Y.

TRADE—Taylor anemometer with zero reset and on-off. Want scope and VTVM or good 2-meter station. Jack Margolis, 721 N. Fuller, Los Angeles 46, Calif.

FOR SALE—Supreme diagram man. 1939-1950 comp., perf. cond. $14.50 FOB; Mallory Service Encyclopedia, 6th ed. $1; Rider "Inside the Vacuum Tube", like new $3. Elton Hoornstra, 305 Ann St., Sault Ste. Marie, Mich.

WANTED—Auto radio for '48 Studebaker. Will accept radio needing repairs; cash or trade. Fred A. Blacquier, 29 Magnolia Ave., Cambridge, Mass.

FOR SALE—Superior channel analyzer with VTVM; GE tube and battery tester; Supreme No. 599 tube and set tester; $100 takes all. Edward Stein, 2910 Schley Av., N. Y. 61, N. Y.

SELL OR TRADE—NRI comm. course (78 lessons) covering radio and TV 1951 ed. Best offer of ham or serv. equip. or cash. J. E. Loff, 7103 3rd Ave., Apt 3-c, Brooklyn 9, N. Y.

FOR SALE—Tube tester; VTVM; VOM; sig. tracer; scope; typewriter; camera; mimeograph. Send stamp for list. John Trowbridge, 655 W. 81st St., Chicago 20, Ill.

TRADE OR SELL—Astatic AT1 4 tube TV booster $27.50; Mercury II f3.5 35mm camera and case, like new $37.50. Want reflex camera and S-38 rec. Gerald Manning, Rocky Face, Ga.

FOR SALE OR TRADE—Hallicrafter S-20-R, good cond. For cash, wire recorder, typewriter, movie projector, or what have you? Joseph M. Malak, Center and Sperry roads, Chesterland, Ohio.

FOR SALE—Pider and Uslan's FM Transmission and Reception, 400 pages, good cond., $1.50. Augustine Mayer, 561 S. Sandusky St., Tiffin, Ohio.

FOR SALE OR SWAP—7mm Mauser rifle in exc. cond., hand-dressed and highly polished stock, for good tube checker. Also have Hickok sig. gen, mod. 188-X, in exc. cond $75. Roy W Smith, 165 Milky Way, Clemson S. C.

FOR SALE—Jensen coaxial speaker, mod. JHP52, type 601, 15", exc. cond. $35. Irwin Karabush, 4913½ W. Quincy, Chicago 44, Ill.

WANTED—Auto radio for '51 Kaiser. Will trade parts, test equip. or pay cash. Will pay cash for good 5" scope. L. B. Converse, 1302 S. 19th St., Temple, Tex.

WANTED—1939 Plymouth auto radio. Will pay cash. Chas. Cerami, 146 Congress St., Newark N. J.

FOR SALE—Hickok 505A oscilloscope $165; 610A align. gen. (latest mod.) $180; both like new. J. E. Smith, 361 Summit Ave., Schenectady, N. Y.

WANTED—Tube tester, up-to-date, portable, A-1. C. Gabler, 1307 Merriam Ave., Bronx 52, N. Y.

FOR SALE—Hallicrafter short wave comm. receiver in good cond. Byron Rudinsky, 1101 Manor Ave., Bronx 72, N. Y.

FOR SALE—7DP4 picture tube, electrostatic focus, magnetic deflection. Local buyer only M. Herman, 417 Raritan St., Camden, N. J.

FOR SALE OR SWAP—GE rechargeable portable radio. Alum. case with extra vib. Will swap for test equip. or cash. H. Posner, 102-14 101 Ave., Ozone Park, N. Y.

WANTED—Ham equip., in good cond., reasonable, in NYC area. N. Birnbach, 720 Riverside Dr., N. Y. 31, N. Y.

WANTED—School radio club wants Instructograph or similar device for use in learning radio code. Price must be reasonable as our funds are low. B. Annenberg, Thomas Jefferson High School, Brooklyn 7, N. Y.

WANTED—Sonar 2 meter rec. (SR-9) or equiv.; will pay cash or swap. Have German 8mm rifle, SW-54 rec.; British sniperscope image converter tube. Robert Meyer, 193 Bedell Ave., Staten Island 7, N. Y.

SELL OR SWAP—Navy LM-10 freq. meter covering 125-20,000 kcs unmodified with modulation, calibration chart, crystal and tubes for $50 or AM-FM rec. Frank Flack, 106 Nun St., Wilmington, N. C.

FOR SALE—Hallicrafter S-38, good cond., $17.95; Mallory VP-552 $12.49; 1000W, adjustable link, push-pull const., plug-in type coils with jack bar, 80, 40, 20 meters $9.95. Dallin H. Oaks, 45 N. 6th, E. Provo, Utah.

FOR SALE—Capacity relay; EL-tronics B-100 with instruction man. etc., comp. $45. Tompkins Sq. Radio Co., 117-119 E. 7 St., New York 9, N. Y.

WANTED—Disc recorder. Send all information to R. E. Gambetta, 69-4 Franklin St., Paterson, N. J.

WANTED—1941 Superior Utility tester, AC volt or amp. meters; wire or tape recording assy.; timers; elec. razors; 8-day clocks; buy or swap. Have tubes, vol. controls, Mica cond. print. equip. etc. to sell or swap. F. Cabon, 4207 Council, Los Angeles 4, Calif.

FOR SALE—Precision E-200 gen. $25; NRI radio course less exp. kit $15. Alfred A. Johnson, 5604 N. Western Ave., Chicago 45, Ill.

WANTED—Complete set Sam's. B. A. Bolton, 433 Main St., Stamford, Conn.

FOR SALE OR SWAP—2 Standard coil TV tuners; Philco TV booster; BC-221 freq. meter. Want good binoculars, YHF-152, cash or what have you? L. D. Dillin, 2445 N. Orchard Dr., Burbank, Calif.

SWAP—10-35 cal. Italian pistol in ex. cond. for sig. tracer. Bill's Radio Repair, 1306 W. Cleveland, Guthrie, Okla.

FOR SALE—GE H-4 transformer $15 plus post., with diagram. Used for S-4 Sunlamp, AH-4 Mercury and BH-4 red ruby lamps. George Neuschafer, P. O. Box 883, Kerrville, Tex.

WANTED—Turnover or tandem type record changer (Markel, Lincoln, Capehart) 78 rpm, 2-speed or 3-speed. Have misc. equip and literature to trade, or state price. Howard Mandel, 131 LaSalle Dr., Tuckahoe, N. Y.

SWAP—RCA 630 TS 10" TV rec. in good cond., with keyed A.G.C. Want dynamic mutual conductance tube tester in good cond. Marty Vincoff, 4849 N. Hutchinson St., Philadelphia 41, Pa.

TRADE—New Lettine mod. 240 transmitter with coils, for TV set. H. L. Evertson, 1035 Wilder St., Helena, Mont.

WANTED—700-0-700 volt 200 mil power transformer, 5v 3A center tapped winding, and 6.3V 5A winding. Also 2 meter rec. Name your price. Jim Chatham, 539 Westview Dr., Winston-Salem, N. C.

FOR SALE—Hammarlund Super Pro or Hallicrafter SX42 with matching speakers. Best cash offer or will trade either for 35mm camera with f2 coated lens in good cond. R. J. Horst, 954 County Rd., B-2, St. Paul 8, Minn.

SWAP OR SELL—Precision sig. tracer, audible and visual check of any trouble for Solar or Sprague cond.-resistor checker. Max M. Finkelstein, 1711 Ocean Parkway, Brooklyn 23, N. Y.

FOR SALE—Radio and TV Sales and Serv. business, next to housing project, low rent, latest test equip., '47 Chev. truck fully stocked, exc. oppty. Illness forces sale, no reas. offer refused. Imperial Radio & TV Service, 456 Cherry St., New York 2, N. Y.

SWAP—Beuscher Gold Tint alto sax for tape recorder. J L Madden, 412 Columbus Ave., Tuckahoe 7, N. Y.

SWAP—Kodak Medalist II, like new, value over $400; inc. backs, cut film holders, flash, etc., or Korelle II with f2.8 Xenar and ext. tubes, etc., value $150. Want Hickok test equip. or? Local if possible. M. Meyers, 2329 Washington Blvd., Venice 68, Calif.

FOR SALE—Hickok VTVM mod. 203 $89; Hickok sig. gen. mod. 288X $105; Precision tube and set tester mod. 954-G $79. All perfect, will sell for $243. N. C. King, P.O. Box 561, Bonifay, Fla.

SELL OR TRADE—Mod. 600 Superior multitester, comp. with test leads. Latest tube testing information $40 or bargain for Precision E-200-C or NRI sig. gen. Robert Murray, Jr., Box 353, Millsboro, Pa.

FOR SALE—Hallicrafter S-53 rec., 2 yrs. old, $50 FOB. C. L. Gemmill, Box 1502, University Station, Charlottesville, Va.

FOR SALE—Time clocks taken off Coin Radios, Tradios, RCA and Coradios, $1.50 and $2.50 ea. FOB Birmingham. Meade Radio & Television Co., 2830 Fairway Dr., Birmingham 9, Ala.

SELL OR TRADE—PE 103 Dynamotor, comp., exc. cond. $32. Need com. griddipper. R. A. Farmer, 7904-C Knollwood Rd., Towson 4, Md.

SELL OR SWAP for sailboat—12 asst. hi quality panel meters, multimeter, AM gen., audio osc., 33⅓-78 rpm rec. mech. power xformers, chokes, comm. rec. etc. Paul Turkheimer, 91 Ft. Washington Av., New York 32, N. Y.

FOR SALE—National NC100X crystal phasing, 540K-30M matching speaker, over $200 new, needs repair; '47 Admiral table comb. radio-phono., exc., over $55 new. Best offers. Russell F. Calkins, 20 West St., Keene, New Hampshire.

FOR SALE—Rider 1-15; Hickok traceometer mod. 156; power transformers; speakers; coils; SCR522 with supply; BC 620; BC-645 test panels, meters, gens. Make offer. George Dowers "Laboratory", R 1, Cocoa, Fla.

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